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Abstract

DOUBLE REACTOR CONTAINMENT MEETS THE SITE REQUIREMENTS FOR A CIRCULATING LIQUID FUEL REACTOR

H. Wijker
N.V. KEMA, Arnhem, Netherlands

The 250 kW Kema Suspension Test Reactor, a circulating liquid fuel reactor, is under construction on the KEMA-grounds near Arnhem, the Netherlands. The principle of double reactor containment is applied to meet site requirements concerning dose limits at zone boundaries as used by the U.S.A.E.C.

The reactor system (first barrier between the suspension and the outer atmosphere) is placed in steel compartments, backed up by the concrete of the biological shield (second barrier, first reactor containment), which in turn are placed in a concrete reactor hall (third barrier, second reactor containment).

The contingent release of radioactive gases to the environment will be considered for 4 cases, viz. normal operation, maintenance, a major accident, and a hypothetical accident.

The maximum concentration of radioactivity in the gases discharged from the 25 m high stack is set by the authorities to be 10^{-7} curie/m^3 for design purposes. To maintain the underpressure in the nitrogen filled compartments during normal operation, gases are discharged through the stack via charcoal adsorption beds for delay and will always pass absolute filters and iodine traps.

For maintenance purposes after shut down of the reactor the compartments have to be opened. Beforehand they have to be practically free of radioactive gases that might have leaked from the reactor system. This is achieved by a combination of decay and purging. To complete this within reason-

able time the concentration of radioactivity in the stack effluent has to exceed 10^{-7} c/m^3 for short times. This concentration will not reach the value of 10^{-4} c/m^3, being the limit at which the valves in the stack and the ventilation inlet duct will close automatically.

In the case of a major accident (release of the reactor content into the intact compartments) this limit is reached and the valves are closed. The arguments that the integrity of the first containment remains intact are discussed. Decay and controlled release via an emergency charcoal adsorption bed make it possible to remove practically all of the radioactive gases from the compartments in about 3 months without violating the site requirements.

Even for a hypothetical accident in which all fission gases (700 kc) are released into the reactor hall, the site requirements can be met.

To show this one of the points to be considered is the meteorological dilution between the stack and the dose receptor. Due to the small distances to inhabited regions, also the concentration of radioactivity above ground level has to be considered. For a vertical plane through the stack and the wind direction a graph, based on Sutton's formula, was constructed to locate the point of maximum concentration in these inhabited regions.